

CHEMICAL EXAMINATION OF URINE,

Compliments of
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COMPILED AND ARRANGED BY

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For the use of the Students of the Miami Medical College of Cincinnati, Ohio.

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In the examination of urine, observe: I. Quantity passed in twenty-four hours. (1). II. Color and transparency. (2). III. Odor. IV. Reaction. (3). V. Specific gravity. (4). VI. Presence or absence of sediments.

EXAMINATION OF THE CLEAR URINE. (5).

VII. ALBUMEN. (11).—To the clear urine, if it has not a distinctly acid reaction, add a large excess of nitric acid (HNO_3), and boil: an opacity indicates the presence of *albumen*.

VIII. SUGAR.—Remove the albumen, if present, by filtering the above, and to the filtrate add an equal amount of sodium or potassium hydrate (NaOH or KOH .) and a drop or two of a dilute solution of copper sulphate (CuSO_4), heat nearly to boiling without shaking, when a yellow cloud will form on the surface, and soon a yellow or red precipitate of the oxide of copper will follow without further heating, if *sugar* be present. To confirm the presence of sugar, prepare another sample in the same manner, and allow it to stand quietly for 6–24 hours, without heating.

IX. NORMAL COLORING MATTERS.—1. UROHÆMATIN OR UROCHROM.—Dilute the 24 hours' urine with distilled water until it measures 60 oz. (1800 c. c.); or, if the quantity exceeds 60 oz., concentrate to this amount, then add to about 2 dr. (7. 4 c. c.) of it in a test-tube, $\frac{1}{2}$ dr. (1. 8 c. c.) of pure concentrated nitric acid, and allow the mixture to stand for some time. If *Urohæmatin* is in normal quantities, only a slight change of color will be seen; but if in excess, it will become pink, red, crimson, or purple according to the amount present.

2. INDICAN OR UROXANTHIN.—To 3 or 4 c. c. of pure concentrated hydrochloric acid (HCl .) in a beaker, add while stirring, 10 to 20 drops of urine. If in normal quantity, the solution will be colored pale yellowish-red. If in larger quantities, the coloration will be violet or blue. If biliary acids are present add lead acetate [$\text{Pb. (C}_2\text{H}_3\text{O}_2)_2$], filter, and then test for *Indican*.

X. ABNORMAL COLORING MATTERS.—1 BLOOD.—Add sodium hydrate to the urine, and the earthy phosphates will be precipitated. If blood is present the precipitate will be blood-red instead of white.

2. UROËRYTHRIN.—Known by the pink coloration of the sediment known as “lateritious,” or by the formation of a pink-colored precipitate, with a few drops of lead acetate. If the urine contains hæmatin, or the coloring matter of blood, it must first be removed.

3. VEGETABLE COLORING MATTERS.—Known by the red alkaline urine turning yellow on the addition of an acid, and acquiring a red color again on the addition of ammonium hydrate (NH_4OH)

4. BILIARY COLORING MATTERS.—Pour into a beaker 6 c. c. of pure concentrated hydrochloric acid, and add to it, drop by drop, just sufficient urine to color it; “underlay” the mixture with pure concentrated nitric acid. A beautiful play of colors will appear if *biliary coloring matters* are present.

XI. BILIARY ACIDS (15).—Pour 10–12 drops of the urine on a piece of porcelain and add to it about 3 drops of pure concentrated nitric acid. If bile is present a change of colors will take place, green and pink predominating. Or add to the suspected urine, albumen, and coagulate with nitric acid; after standing the coagulum will have a bluish color. A solution of lead acetate added to urine containing bile, produces a yellowish precipitate. Tincture of iodine produces a beautiful green, varying from rose to yellow color. No secretion, except bile, will give this green coloration. (M. Maréchal's test).

XII. URIC ACID.—A small portion of the sediment, or residue after evaporation, is placed in a porcelain dish, and a drop or two of nitric acid added to dissolve it, it is then carefully evaporated to dryness on a water bath. When dry, add a drop or two of ammonium hydrate, and a beautiful purple-red color will instantly be seen.

XIII. CHLORIDES (7).—Add silver nitrate (AgNO_3) and nitric acid. A white precipitate indicates the presence of chlorides (6).

XIV. PHOSPHATES.—1. EARTHY PHOSPHATES (8).—Add ammonium hydrate in excess, and boil. A precipitate indicates *earthy phosphates*.

2. ALKALINE PHOSPHATES (9).—Filter the above, and to the filtrate add a solution of magnesium sulphate (MgSO_4). A white crystalline precipitate indicates the presence of *alkaline phosphates*.

XV. SULPHATES (10).—Add to the urine a solution of barium chloride, and an excess of hydrochloric acid. A white precipitate indicates the presence of sulphates.

EXAMINATION OF THE SEDIMENT.

Decant as much of clear urine as possible, and shake up the remainder in order that the sediment may be suspended.

I. URATES.—Heat a portion of the above to boiling, and the urates will dissolve. If a residue remains, filter, and test the filtrate for uric acid according to XII, or cool the filtrate, and crystals of the *urates* will slowly form.

II. PHOSPHATES.—If a residue remains undissolved in the proceeding, heat another portion of the sediment with acetic acid ($\text{C}_2\text{H}_4\text{O}_2$), and, if necessary, filter, and to the filtrate add ammonium hydrate and heat. A white precipitate will indicate the presence of *phosphates*.

Further examination of the sediment for mucus, pus, urea, &c. is best made by the aid of the microscope, (12), (13), (14).

NOTES.

1. The normal amount of urine passed in 24 hours is about 40–50 fluid ounces.
2. The normal color of urine is *pale yellow* or *amber hued*.
3. The reaction of normal urine is *acid*.
4. The specific gravity of normal urine varies from 1,005 to 1,030, according to age and sex, constitution of body, and food.
5. If the urine is not clear it should be filtered before beginning the examination.
6. If the amount of urine passed in 24 hours is normal, the precipitate of the *chlorides*, according to XII, should be about of the consistency of milk.
7. The presence of a moderate amount of *albumen* does not interfere with the tests for *chlorides*, but if it is abundant, it must be removed.
8. Normal urine, which has been recently passed, should contain no sediment of *earthy phosphates*.
9. A milk-like cloudy appearance indicates about a normal amount of *alkaline phosphates*.
10. A milk-like cloudy appearance indicates about a normal amount of *sulphates*.
11. A rough test for *albumen* may be made in the sick room by boiling some of the urine in a spoon.
12. Urine containing *mucus* is generally cloudy, ropy and alkaline.
13. Urine containing *pus* is generally acid, and the pus settles to the bottom readily. On the addition of sodium or potassium hydrate to the sediment, it forms a gelatinous mass.
14. Urine containing *fat*, is milky, opaque and albuminous. The fat comes to the surface on standing.
15. Urine containing bile has a brown color.

Decant as much of clear urine as possible, and shake up the remainder in order that the sediment may be suspended.

...the water will slowly form...

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2. The normal color of urine is pale yellow or amber hue.

The specific gravity of normal urine varies from 1.005 to 1.030, according to age and sex.

5. If the urine is not clear it should be filtered before beginning the examination.

7. The presence of a moderate amount of adipose does not interfere with the tests for case-

... which has been recently passed, should contain no sediment of earth

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11. South East for adjacent map to be made

12. This containing waste is generally caustic and alkaline.

Quakley (W. L.)
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